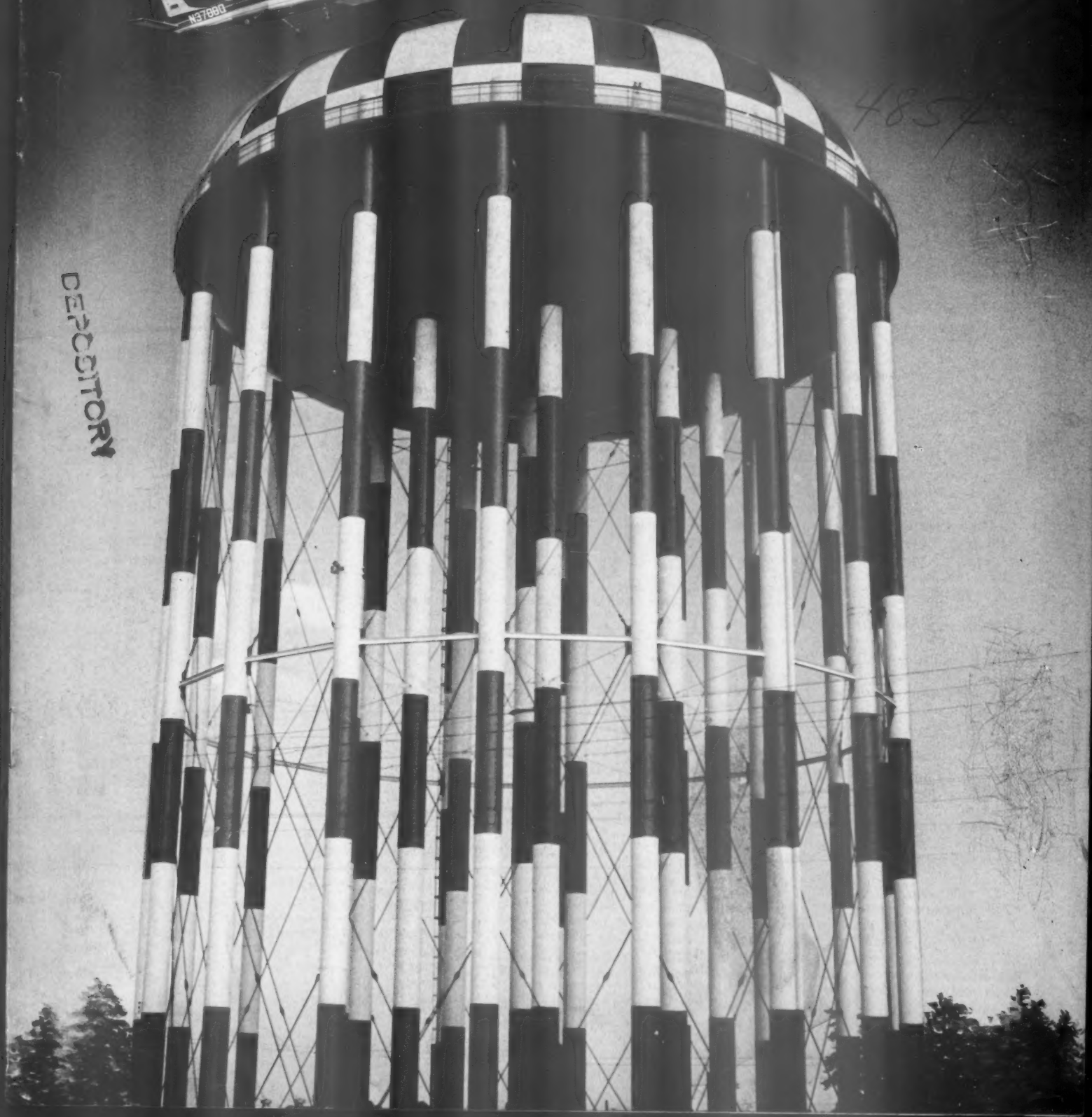
FAA AVIATION NEWS

SEPTEMBER 1968



DEPOSITORY

COVER

Higher speeds of modern aircraft underscore the importance of clearly marking tall obstructions. For FAA guidance, see page 8.

FAA AVIATION NEWS

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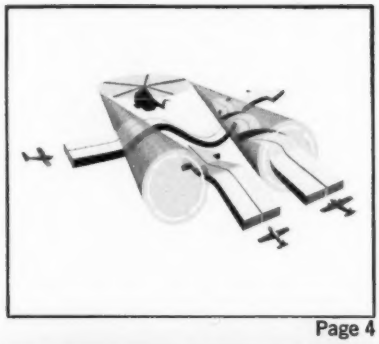

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Above—Pilot sprinkles chaff into slipstream following inflight radio failure. Metallic properties of chaff brighten radar returns. Below—Chaff comes in flip-open box packed with long and short metallic strands for long or short range radar contact.

New Inflight Emergency Procedure

CHAFF DROPS

Locate Lost Aircraft

Small packets of metallic confetti dropped from an aircraft may save the day for a general aviation pilot who is either lost or experiencing a communication failure.

These packets, usually made of aluminum foil and called *chaff*, may be tossed out of a small airplane by a pilot to paint a distress signal on a radarscope and alert an air traffic controller of an emergency situation.

FAA included the chaff dropping technique in its list of emergency procedures, effective July 1, 1968, after specialists observed hundreds of drops over a four-year study period.

Now marketed by at least six manufacturers, chaff is packaged in small rectangular boxes weighing about six to eight ounces, and measuring 1" x 6" x 8". Four small boxes, the number needed to complete one emergency procedure of four drops, are packed in a cartoon selling for about $10.

Chaff has a metallic coating that returns a prominent signal when dropped within range of FAA air route or airport surveillance radar antennas. The enhanced aircraft target indicates a communication failure, and the need for inflight assistance.

Pilots intending to declare an emergency in this manner should use the following procedure:

"If unable to communicate and equipped with chaff, fly a straight line and drop a box of chaff every two miles until four drops have been made. Continue on course for two miles and then make a 360 degree turn to the left at a rate of three degrees per second. Repeat the 360 degree turns at two-mile intervals until four turns have been completed. The chaff pattern will enhance the possibility of detection by the radar controller and will assist him . . ." *(Airman's Information Manual).*

A controller also may request a pilot who is lost to drop chaff as a means of establishing the aircraft's position, even though the aircraft transmitter and receiver are working. But pilots are cautioned not to drop chaff unless they are declaring an emergency.

Previously, the standard procedure for an aircraft with a radio failure had been to fly a triangular pattern—to the right if the receiver is operating and to the left if both transmitter and receiver have failed. Air traffic controllers observing such patterns on the radarscope were expected to render assistance to the aircraft.

However, a test of the triangular pattern procedure in 1964 by Don Downie, a West Coast pilot and journalist, led FAA to seek other ways of detecting an aircraft with a communication failure. Mr. Downie made several flights testing the triangular pattern emergency procedure with an FAA Flight Standards Service inspector aboard, without instigating a response from Air Traffic Service. After requesting ideas from controllers, industry and pilots, FAA assigned the task of testing chaff dropping to John Berta, an air traffic control specialist.

With FAA and AOPA pilots cooperating, chaff drops were made within a 50-mile radius of the nation's capital. Chaff was dropped from small aircraft at altitudes of 10,000, 6,000 and 2,000 feet. Chaff dropped from the two higher altitudes registered distinctly on radarscopes. The four distinctive "blips" lingered on the displays for more than half an hour before dissipating, and resembled storm areas. The drops from 2,000 feet were less distinct but targets were registered in most cases.

Spacing drops at two-mile intervals, it was learned, paints a pattern on radarscopes which resemble the four slashes registered on the radarscope by a transponder squawk on emergency beacon code 7700.

Use of chaff is an effective means for a pilot of a general aviation airplane to declear an emergency, since many smaller aircraft are not equipped with transponders, and both transmitting and receiving radio equipment may fail.

(The triangular pattern procedure is still recommended as an alternate, although it is less effective than chaff.)

Strips of chaff intended for detection by air route surveillance radar (ARSR) are about four and a half inches in length and those for use with airport surveillance radar (ASR) about two inches long. The different lengths correspond to the different radar frequencies in use. Packets are designed to open in the slipstream and scatter after being dropped from an aircraft.

Chaff was first used by the British during World War II as a device to create confusion by painting false targets on enemy radar. This military application still exists; chaff bundles are also placed in parachutes and ejection seats to aid in locating downed crews.

Advisory Circular 90-36, dated May 22, 1968, on the subject, "The Use of Chaff as an Inflight Emergency Signal," can be obtained without charge through the Department of Transportation Distribution Unit, TAD-484.3, Washington, D. C. 20590. Similar information on the use of chaff can be found in Part I of the *Airman's Information Manual.* ■

Wake turbulence is generally associated with large, fixed-wing aircraft, particularly jet transports. Almost overlooked is the considerable turbulence stirred up by helicopters. As the number of rotary wing aircraft increases with each year, this presents a growing problem in air terminal areas.

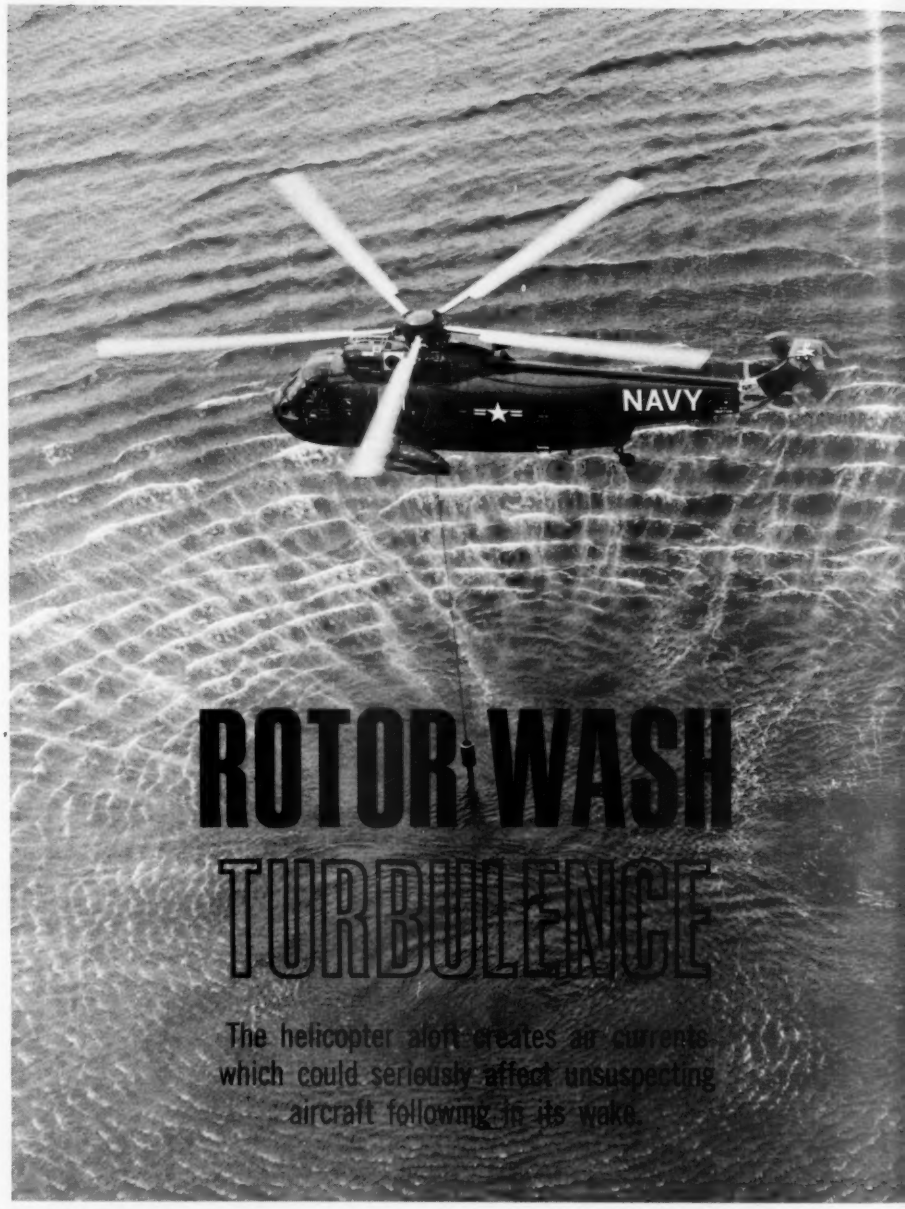
Even though it has no wing tips in the conventional sense, a helicopter in forward flight generates wake turbulence with twin vortices similar in form to those created by fixed-wing planes. Moreover, while a fixed-wing aircraft produces wake turbulence only while moving through the air, a hovering helicopter directs a forceful blast of air downward that rolls outward as it strikes the ground.

The downwash is compressed into a disc one-half the area of the rotor disk, and speeded up to about twice the velocity developed at the rotor plane. This torrent of air is re-circulated through the rotor, creating a continuous turbulent column of air that radiates part of its force outward, like ripples in a pond. A typical downwash velocity under an S-58 helicopter in hovering flight is about 60 feet per second (35 knots).

This is sufficient to upset nearby unmoored aircraft, to buffet loose control surfaces, and to hurl debris of considerable weight through the air.

Wake turbulence is created by an airplane's wings—or rotor blades—moving through the air to produce lift. The mass of disturbed air follows the flight path in a relatively flat plane but its character changes very rapidly. At about 200 to 600 feet from the source, (roughly two to four wing or rotor spans of the aircraft) it forms into two distinct vortices, one at each wing tip.

These vortices are formed by air spillage about the wing tips which rolls the disturbed air into whirling cylinders. The vortex swirling off the right wing tip spins counter-clockwise, that from the left wing rotates clockwise. With helicopters, each rotor blade in effect is a wing, and sheds its own vortex; these numerous vortices soon rearrange themselves when the helicopter is in forward flight to form twin vortices exactly like those formed by fixed-wing planes.


NAVY
ROTOR WASH
TURBULENCE
The helicopter aloft creates air currents which could seriously affect unsuspecting aircraft following in its wake.

Turbulence generated by this hovering Navy helicopter forms powerful downward currents and creates a visible indication of "ground effect" on the surface of the sea.

These vortices are quite powerful and may persist for several minutes after the helicopter has passed. Pilots have reported feeling the effects of what they believe to be wake turbulence five minutes, and more after passage of aircraft. There is no practicle way to predict how long a wake trail will persist, or how forceful it will remain.

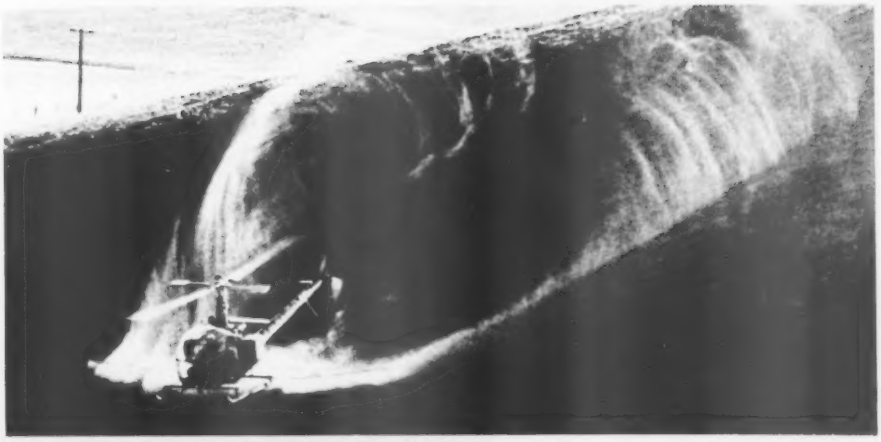
Turbulence intensity is directly proportional to the weight and inversely proportional to the wing or rotor span and speed of the aircraft. Thus, a heavily laden, long-range aircraft will create a more violent wake on takeoff, than it will on landing when tons of fuel have been burned.

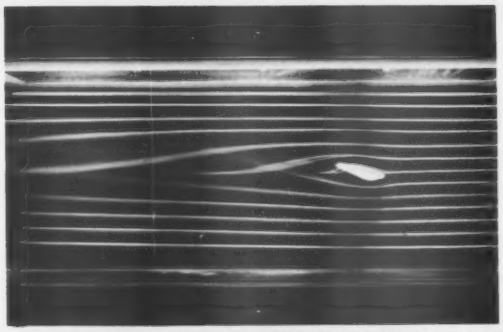
The average velocity and the total energy of the rotor wash in the wake of a helicopter in forward flight is similar to those of an airplane of the same weight and the same airspeed.

The trailing vortices, one rotating clockwise the other counter-clockwise, produce a downward motion in the space separating them. The vortices settle or move downward with time. Helicopter vortices generated more than a few rotor diameters above the ground retain their individual integrity—they do not merge—but in operation closer to the ground their motion is slowed, and they begin to spread across the ground.

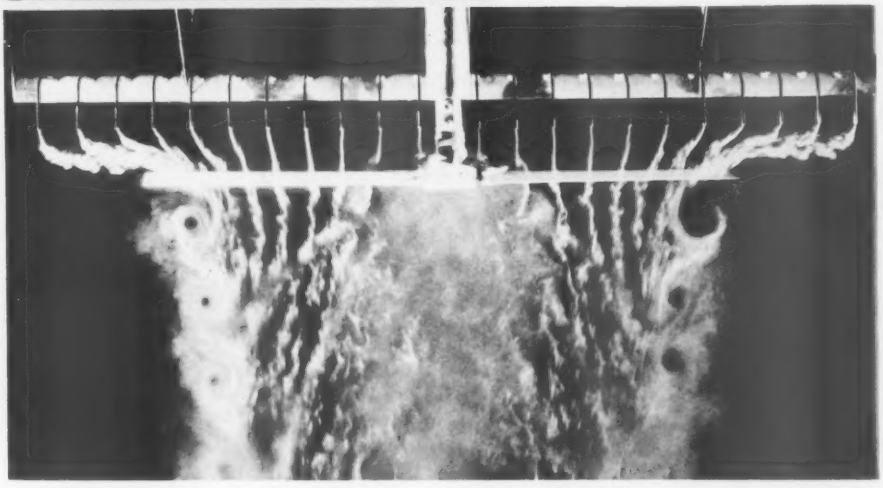
Weather and wind have a direct effect on the persistence and force of the vortices. A wind of only about five knots, or even convective action due to heating, will contribute to rapid decay or complete disruption of the vortices. Vortices close to the ground are "worn down" and dissipated by ground friction. In smooth air, however, the continuity of vortex cores can be maintained for miles—a jet plane's contrails are a good illustration—before they are torn apart by wind shear, turbulence, convection, or internal friction of the rotating mass of air.

Light aircraft on take off and landing,





Above—An ag helicopter applying chemicals to a crop shows the vortex currents caused by its forward motion (similar to fixed wing craft). Left—Smoke trails in a wind tunnel illustrate the effect of air passing over a stationary rotor. Below—Moving rotor forms distinctive patterns with smoke issuing from pipes in foreground. The primary turbulence is downward with minor vortices forming at the rotor blade tips.



and during flight at lower altitudes in the airport vicinity where helicopters are operating, should be especially alert to the hazards of wake turbulence. Serious danger lies in flight *through* the wake, flight *between* vortices, and flight directly *into* one of the vortices. Each has a different effect on the pentrating aircraft.

A light plane flying through the two parallel vortices of a helicopter will undergo aerodynamic loads similar to those imposed by heavy gusts.

The design limits of the penetrating aircraft could easily be exceeded, resulting in destruction of the plane. Fortunately, the strength of the vortices decreases rapidly, and little danger of structural damage is likely if the wake is penetrated more than a minute after passage of the generating aircraft.

Light planes should never attempt to cross the track of larger aircraft at the same, or lower altitude.

Flying between the vortices subjects the penetrating aircraft to strong downward pressure which can literally knock the plane out of the air. When a light plane with a climb capability of 1,000 to 1,200 feet a minute encounters this avalanche of air, there is only one likely direction of travel—down. At low altitudes, this can be disastrous.

Accompanying hazards are the vortices on either side. A pilot caught between them could find himself in worse trouble by attempting a left or right turn. Either way, he would be turning into the core of a vortex.

This combination of vortices is encountered during climbout, landing approach, and formation flying. This vortex carries dangerous potential up to two minutes after the generating helicopter has left the scene.

Flying directly into one of the vortices probably represents the most dangerous penetration since it subjects the intruding aircraft to violent rotational forces. This spinning air can produce a roll rate of about 80 degrees a second, which is about twice as fast as some light planes can roll using full aileron deflection.

In a test employing a T-28 and an H-19, both aircraft of approximately the same gross weight, a 36 degree-per-second roll was induced in the T-28, even though it passed 1,000 feet aft, and 200 feet below the H-19. The pilot, highly experienced and alert to the possible consequences, had to use about 90 per cent of the total available lateral control in less than one-half second to stay nearly level. This could have been very hazardous within 300 feet of the ground.

The greatest area of danger from helicopter vortices comes from vertical lift landings and takeoffs. If the wind is blowing in the opposite direction and at the same rate as the lateral spread of the vortex, the vortex could remain stationary for minutes right above the runway—long after the time it could normally have been expected to dissipate.

Helicopters hovering closer than 1,000 feet upwind of an active runway create a subtle hazard because of their apparently safe distance and the fact that the craft is not in motion. This is a false assumption. The downwash of a hovering helicopter mushrooms when it strikes the ground, and while a considerable amount of this air is re-circulated through the rotor, some of it will advance at a rapid rate along the surface of the ground. Helicopters should not be operated at high thrust under no-wind conditions closer than three rotor diameters to other aircraft.

Wake turbulence and helicopter rotor wash are fundamentally the same and they have the same upsetting effect on other aircraft. The slow forward movement of a helicopter can be misleading when taken as an indication of wake turbulence. Churning air from any source or by any name is a potential upsetting agent. Look out for rotor wash. ■

(Additional information on wake turbulence, and recommended FAA air traffic procedures can be found in Part I, *Airman's Information Manual*).

LOOK BEHIND THE POST

PERSPECTIVES

The first law of flight safety is that two airplanes cannot safely occupy the same block of airspace at the same time.

An understanding of the laws of perspective can help pilots avoid such an occurrence. This is the first article in a series on collision avoidance, suggested by Myrl C. Rupel's book, "See and Be Seen."

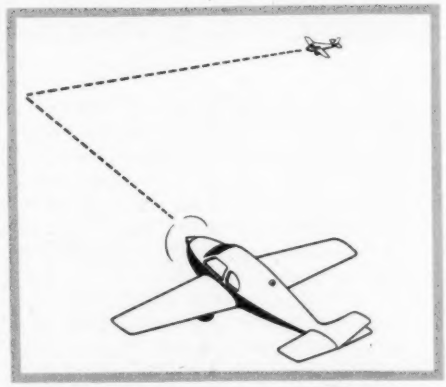
Although most mid-air collisions—or near mid-air collisions—are the result of pilots not seeing the other aircraft in time, some incidents do occur in spite of the fact that the visibility is unlimited and the aircraft involved are in plain view of each other.

This type of hazard is accounted for by the unfamiliarity of many pilots with aerial perspectives. If a pilot sees another aircraft or a ground structure dead ahead, he will immediately take evasive action. However, if he sights another aircraft somewhere abeam, on a converging course, what basis does he have for judging whether the two planes will attempt to occupy the same airspace at the same time?

Some pilots will feel relatively safe as long as the other aircraft remains back of the door post, and will only become concerned if it moves into the area covered by the front windscreen. But in point of fact, a potentially hazardous situation exists whenever the converging aircraft appears to hold a constant position in relation to your own aircraft.

Perhaps the most serious danger is presented by the aircraft which remains half hidden by the doorpost, since you could lose sight of it. But regardless of its relative position—back of the post or in front of it—if the other plane appears to be standing still, you should alter course immediately to remove all possibility of a conflict. What you can't see, *could* hurt you.

There is plenty of airspace up there. Use all you need, and leave enough for the other fellow. ■



Converging aircraft at the same altitude may or may not meet, depending on the airspeed and angle of convergence.

500 CAT III LANDINGS

Hands-Off Data Provides Ceiling Zero Requirements

Recently completed tests at FAA's National Aviation Facilities Experimental Center (NAFEC) at Atlantic City have provided the agency with data for establishing instrument and pilot requirements for aircraft when the ceiling and the runway visual range are virtually zero.

FAA pilots made more than 500 successful landings during a month-long flight evaluation of a prototype automatic all weather landing system (AWLS) developed by the Lockheed-Georgia Co. under a joint FAA-Air Force program.

The recent tests, the second phase of a two-part series, were designed to evaluate landing equipment under CAT IIIb conditions (ceiling zero and 150-foot runway visual range).

All decisions controlling the entire landing sequence of the turbofan C-141 Starlifter used in the tests were controlled by small but complex computers, each about the size of a shoe box. While the pilot's role is that of a monitor, the AWLS can be "overpowered" by the pilot, who can elect to land manually or take the plane around for another try.

During the tests at NAFEC, zero ceiling and visibility were simulated, with the pilots "under the hood." About half of the 500 landings were made while the pilot "went along for the ride," with his hands off the controls all the way down. The remainder were flown manually, with the pilot taking over from the computers just before touchdown. Vital parts of the system used in the tests include an improved autopilot coupler, automatic throttles, a radar altimeter, a flare computer, a rotation go-around computer, new flight directors, and a monitor system called a test program and logic computer. Also included in the equipment for the CAT III system are a de-crab and rollout steering computer, plus a manual channel independent of the automatic system. The manual channel includes a second radar altimeter, an additional flare computer, different attitude director indictors, and additional monitoring.

In the first phase of the FAA-Air Force AWLS program, the C-141 was certificated by FAA for CAT II approaches and automatic landings in October 1967. As a result, the Air Force is now installing CAT II and automatic landing equipment in its C-141 cargo and troop-carrying fleet.

The AWLS used in the tests is the product of more than six years of cooperative effort between FAA and the Air Force. ■

An Air Force C-141 Starlifter makes computer controlled touchdown under control of the new All Weather Landing System.

Minimum ceiling and runway visual range restrictions for the various landing categories:

CAT I —200-foot ceiling and 2,400-foot runway visual range.

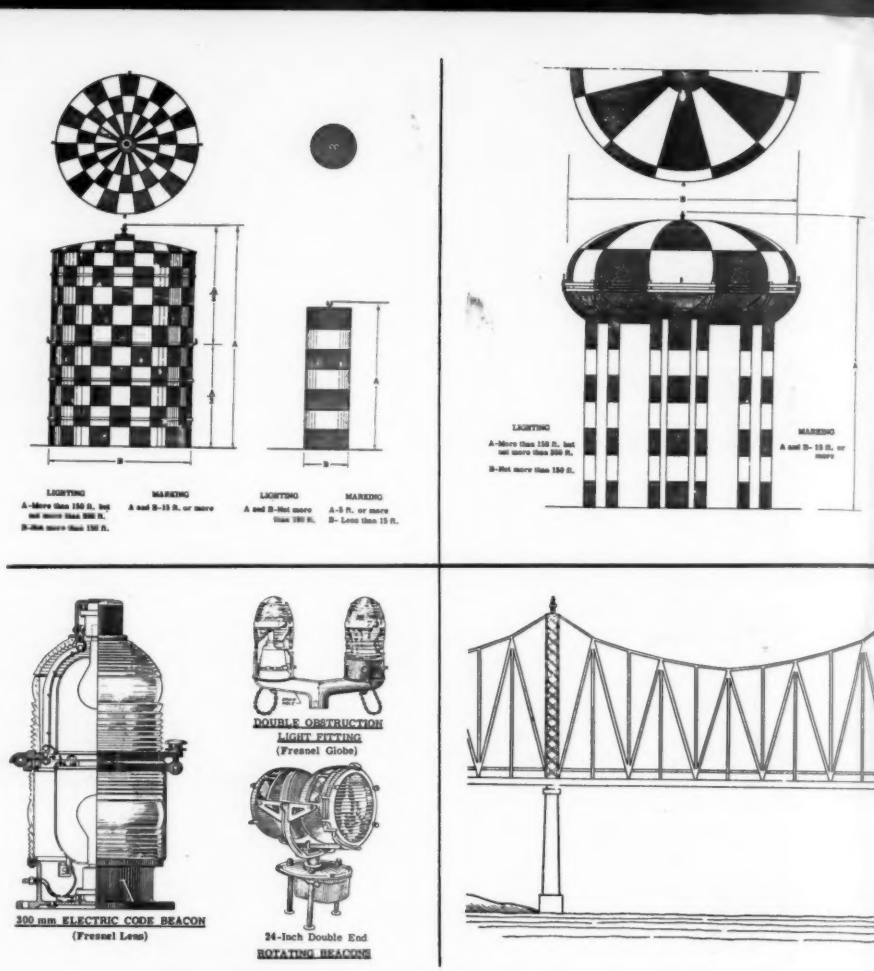
CAT II —100-foot ceiling and 1,200-foot runway visual range.

CAT IIIa—ceiling zero and 700-foot runway visual range.

CAT IIIb—ceiling zero and 150-foot runway visual range.

CAT IIIc—ceiling zero and runway visual range zero.

Above—Inside view of the Starlifter coming in for a hands-off landing at Dobbins Air Force Base, Ga. The procedure simulates landings for reduced visibility conditions down to zero ceiling and 150 feet visual range. With hooded windshield blocking his vision and hands off the controls, the pilot lets the new AWLS take the plane all the way to touchdown. Left—Close-up of instrument panel shows progress display and caution warning instrumentation. Instruments include roll and pitch command, runway deviation indicator, attitude indicator and expanded localizer.



New FAA Guidance for

IDENTIFYING FLIGH

The skies are becoming more crowded—with skyscraping TV and radio transmitting towers, and a steadily growing number of high rise buildings, storage tanks, smoke stacks and silos. Nearly invisible power lines span canyons, valleys and rivers.

Prudent pilots will make a habit of studying current aeronautical charts and approach charts *before* taking to the air on cross-country flights. Attention also should be paid to notices to airmen—airman advisories published in the Airman's Information Manual—and NOTAMS which are updated hourly and are available in flight service stations.

For the unprepared pilot, elevated structures constitute a potential menace to aerial navigation. While every effort is being made by FAA to stimulate marking and lighting of possible hazards to aerial navigation, individual pilot alertness and the following of good flying practices remains the foundation for safety in the air. Intimate knowledge of the aerial hazards around one's own "home" airport is basic life insurance, as is a cautious anticipation of elevated obstacles along any unfamiliar flight path.

Federal Aviation Regulation, Part 77, requires all persons proposing *any kind of construction or alteration* more than 200 feet in height, or which would exceed specified surfaces and heights in the vicinity of an airport, to file a Form 117 with the FAA. These surfaces and heights are specified in Part 77, which also provides for an acknowledgement of each notice received, stating whether or not the object is a hazard to air navigation.

However, Form 117 (the notice of proposed construction or alteration) is purely advisory. At the present time, FAA has no enforcement authority to halt or prohibit construction or alteration that could present a hazard to aerial navigation. However, the FAA has encountered few instances of willful disregard for its recommendations.

The notice of proposed construction does serve a very valuable function because it provides FAA with an up-to-date status report on structures which could present a hazard. It enables the agency to evaluate the effect of the construction or alteration on operational procedures, present and future, and provides a basis for determining possible hazardous effects on air navigation.

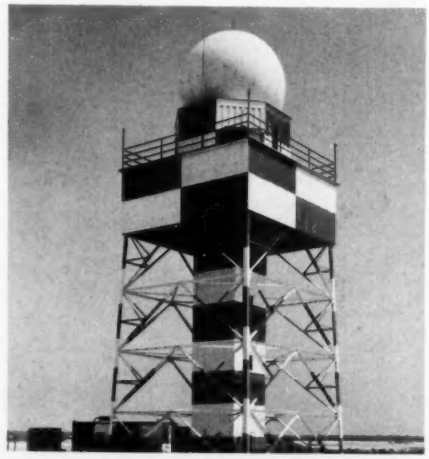
While marking and lighting in the vast majority of cases is purely voluntary, public response to the needs of aerial safety has resulted in a steady trend toward making man-made objects more visible from the air.

The subject is approached realistically and practically in FAA Advisory Circular AC 70/7460-1, "Obstruction Marking and Lighting," a 37-page handbook which deals with every specific facet of the problem.

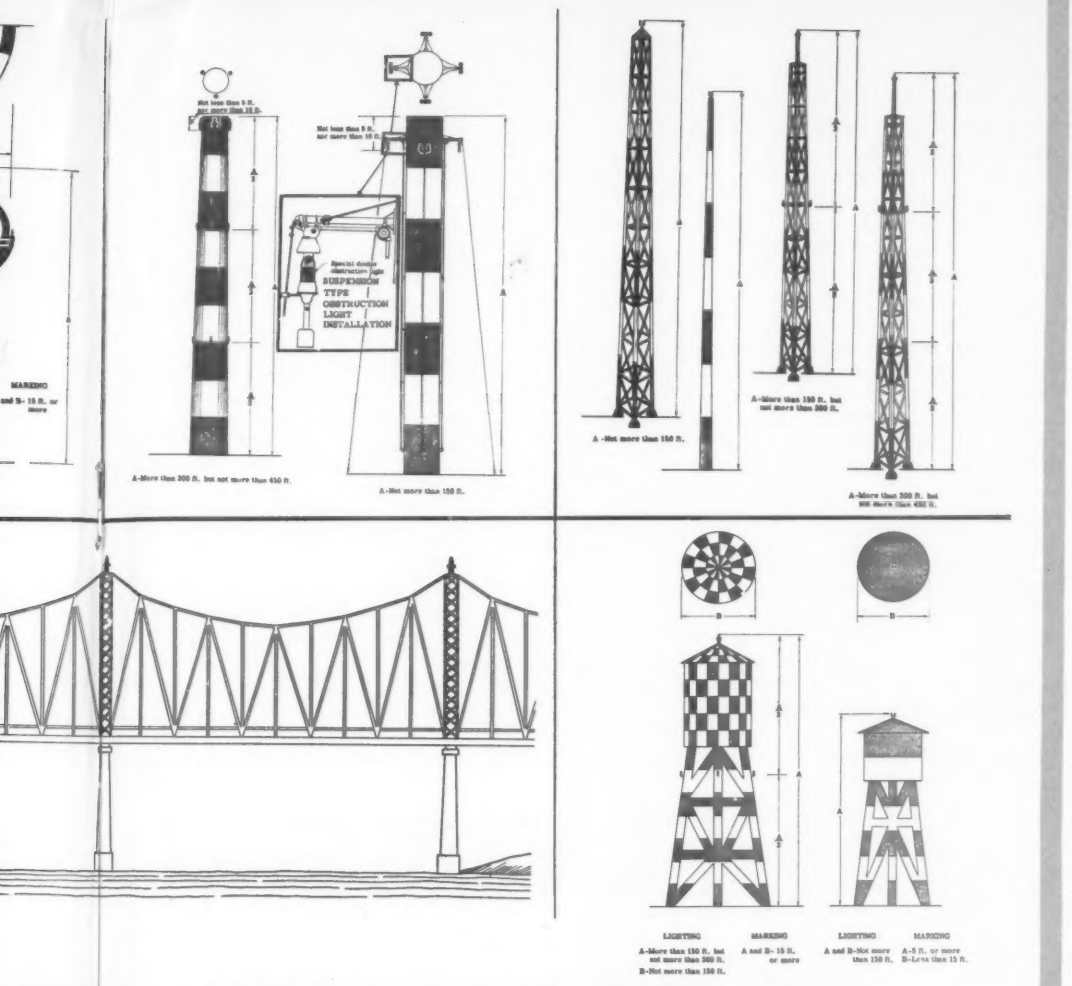
Recommended colors of paint and painting patterns for TV and radio transmitting towers, poles, smoke stacks, water towers and gas holders are described in the text with explicit illustrations. Bridge illumination and the lighting of similar structures is explained and diagrammed. The size and type of lights found most effective under all conditions of visibility are listed. Discussed also is the size and placement of spherical markers on wires, and the use of flags in certain cases.

"Obstruction Marking and Lighting" (FAA Advisory Circular 70/7460-1) may be purchased for 40 cents from the Superintendent of Documents, Government Printing Office, Washington, D.C. 20402. This booklet is a good way of learning how best to overcome the potential danger arising from limited visibility along flight paths, both from the point of view of the airmen and the owner of the elevated structure.

(A companion Advisory Circular, AC 150/5210-5, "Painting, Marking and Lighting of Vehicles Used on an Airport" is a



Superstructure of airport surface detection radar stands out boldly because of the distinctive block design.


SUSPENSION
TYPE
OBSTRUCTION
LIGHT
INSTALLATION
A-More than 300 ft. but not more than 450 ft.
A-Not more than 150 ft.
A-Not more than 150 ft.
A-More than 150 ft. but not more than 300 ft.
A-More than 300 ft. but
LIGHTING
A-More than 150 ft. but not more than 300 ft.
B-Not more than 150 ft.
MARKING
A and B- 15 ft. or more
LIGHTING
A and B-Not more than 150 ft.
MARKING
A-5 ft. or more
B-Less than 15 ft.

GHT OBSTRUCTIONS

Water tower is clearly marked in approved manner to warn pilots from Andrews Air Force Base, on the outskirts of Washington, D.C.

four-page pamphlet which focuses its attention on moveable machinery on an airport. It is available free of charge from the Department of Transportation, TAD 484.3, 800 Independence Avenue, S.W., Washington, D.C. 20590. Request should be accompanied by a self-addressed label).

In 1967, 176 aircraft ran afoul of wires and poles. Twenty-five of these accidents were fatal, claiming the lives of 39 persons. Eighty-four others were injured.

In the first four months of 1968, wires and poles knocked 22 aircraft out of the sky, killing 6 in 5 accidents and injuring 17 in 13 accidents.

Eleven persons were killed in five accidents in 1967 when their aircraft crashed into TV or radio transmitting towers or the supporting guy wires. Another person was injured seriously. As of the end of February 1968, three similar accidents claimed the lives of ten people.

Rarely is the tower itself struck—the supporting guy wires, which even under conditions of optimum visibility are difficult to see, are the lethal factors. In the usual installation, there are three of these arranged 120° apart, and extending outward from the base to a distance of two-thirds the height of the tower. Thus, a 1,000-foot tower can be expected to have wires radiating out about 660 feet. Inboard from these are additional supporting guys, making a snare of wire that stands ready to entrap the unwary pilot who has eyes only for the tower itself.

The problem of obstructions thrusting up into air space has all the indications of becoming graver as broadcasters reach for more sky. There are already five transmitting towers in the U. S. reaching 2,000 feet or more above ground level, and an additional five ranging in size from 1,809 feet to 1,999 feet. A tower at Roswell, N.M. peaks out at 6,266 feet above mean sea level.

Two of these tall towers, the 1,985-footer at Rowena, S.D., and the 2,060-footer at Valley City, N.D. are currently under major repair after being knocked down by aircraft earlier this year. The Valley City tragedy claimed the lives of all four persons in a helicopter which struck one of the supporting guy wires. The 19 persons aboard the airliner that struck a tower guy at Rowena escaped unscathed, although the plane sustained major damage.

The problem of spotting elevated structures is aggravated by the smog created by industrial combustion and other kinds. Also, the concentration of the population into urban areas results in "strip cities"—a metropolitan center and its suburban satellite communities which merge with other similar communities to form megalopolises that provide almost no uninhabited land between them.

The result is a more or less continuous layer of smog and structures thrusting upward, and a generally lowered visibility over large sections of the country.

How can we reduce the danger of mid-air collision with a tower, its guy wires, a bridge, power lines, and other man-made structures?

With the exception of TV and radio transmitting towers, and airports in which Federal funds are invested, FAA has only limited authority as regards marking or lighting of obstructions to aerial navigation.

In the case of TV or radio transmitting towers, a builder must file a "notice of proposed construction" with both FAA and the Federal Communications Commission before commencing work. While the FAA has no authority to deny construction, the FCC can withhold licensing the facility unless it complies with FCC standards, including marking and lighting. These coincide in every detail with FAA recommended lighting and marking standards.

Frank J. Clifford

AG FLYING II

There are probably no more skillful pilots in the nation than the hundreds of ag pilots or "crop dusters" who annually fly over one million hours in the business of aerial application. Yet this group has the highest fatal accident record of any form of commercial or business flying.

In 1966, the latest year for which we have complete figures, the ratio of fatal accidents per hundred thousand flying hours in aerial application was 4.24, compared to 1.45 for business or corporate flying and 0.68 for instructional flying. Is aerial application flying as hazardous as these figures might suggest?

When you consider that most aerial application consists of low level flight in confined areas liberally sprinkled with trees, telegraph poles, wires, water tanks, barns, tractors, etc., the potential for accidents becomes evident.

When you consider the toxicity of some agricultural chemicals, which the slightest shift of wind can bring into contact with the pilot; and when you consider that during the height of the season some pilots may put in a 10 to 14 hour workday, actually catching cat naps in the cockpit between loadings, and that much of their flying may be done at night or in the early dawn with tricky visibility—when all these factors are considered, it is easy to assume that crop dusting is a dangerous job.

Skill, Precision Needed

It is, however, a profession which has been followed for years by hundreds of pilots, many of whom have never had any serious mishaps. Veteran pilots may tell you that crop dusting is *not* a dangerous type of flying for a pilot who is capable of remaining constantly alert and who enjoys the task of applying material over the surface of the ground with a small airplane that is responsive to his slightest movement.

Two factors seem to play an important role in the career of the aerial applicator: experience and carefulness. Most operators of crop dusting outfits will not be interested in taking on pilots who do not have at least several hundred hours of experience in the plane they will be flying. Low level precision flying and the ability to make turns safely in limited areas a few feet above the ground are some of the skills which the ordinary pilot cannot be expected to possess. Only experience can bring this about.

Many pilots prefer to acquire the experience in a training school or in dry run practice, because once the spraying season begins there is never enough time for the pilot to make the acquaintance of his airplane or of his trade. In Northern California recently, a crop dusting operator hired a pilot for night spraying on the pilot's word that he had had some experience in an ag plane. The job involved spraying cabbages in the early hours of the dawn. The pilot was observed by a swamper making one trial approach at far too high an altitude, going around for a second effort, and then burying the nose of the aircraft into the ground. In the post-mortem investigation, it was learned that the pilot had not actually flown that particular ag plane for at least a dozen years, and never at night.

A study of accidents in aerial application emphasizes two phases of the work in which the greatest danger appears to occur. One of these is taking off with a full load, and the other is the turn-around at the end of the swath run. Typical of the fatal accidents listed by the National Transportation Safety Board for 1966 is the following:

September 1, 1967, Taylorsville, Georgia. Pilot 29 years. Flying time 492 hours.

Stall spin on pull up from swath run.

Probable cause—failure to maintain flying speed.

Swath run was made toward rising terrain and exceeded climb performance of loaded aircraft despite load jetison.

Be wary of density altitude.

One of the critical calculations that every aerial applicator must make is the maximum load that he can carry safely at any given moment of the day. The rapidly rising temperatures during the forenoon of a summer day bring about a rapid change in the density altitude, which must be compensated for by a reduction in the load a pilot is carrying, or his safety will be jeopardized.

Not infrequently, a pilot is able to become airborne with a heavy load with the aid of ground effect, only to find that he has little or no control over the airborne aircraft which is actually overloaded for the conditions of flight.

On a day when the temperature is changing rapidly, how can a pilot tell whether or not he is overloaded at any given moment? The basis of his calculations must be "standard air," which is described as 59 degrees Fahrenheit at sea level. Standard air temperature decreases 3.6 degrees Fahrenheit for each thousand feet of altitude rise. The table at the right is a guide.

The turn around at the end of a swath run is a critical maneuver in aerial application. Ag pilot, shown here spraying peanuts in Georgia, will reverse direction with minimum climb.

"STANDARD AIR"

ALTITUDE (Feet)	TEMPERATURE (Fahrenheit)
0 feet	59 degrees
500 "	57.2 "
1000 "	55.4 "
1500 "	53.6 "
2000 "	51.9 "
2500 "	50.1 "
3000 "	48.3 "
3500 "	46.5 "
4000 "	44.7 "
4500 "	43.0 "
5000 "	41.2 "
5500 "	39.4 "
6000 "	37.6 "
6500 "	35.8 "
7000 "	34.0 "
7500 "	32.3 "
8000 "	30.5 "

The High Cost of Low Flight

The rule of thumb for safe aerial application under varying temperatures is as follows:

Reduce your load 1¼ pounds/for each thousand pounds of gross weight of airplane/for each degree of temperature above standard air—up to 5,000 feet altitude. Above 5,000 feet (up to 8,000 feet) reduce your load three pounds per thousand pounds of gross weight for each degree of temperature above standard air. Above 8,000 feet, a more precise calculation than that afforded by rule of thumb should be used.

For example, you have an aircraft weighing 2,000 pounds with a payload of 580 pounds taking off at an airport where the altitude was 2,500 feet above sea level and the standard air, therefore, was 50 degrees F. If the temperature were to be 90 degrees, the difference between standard air and the present air would be 40 degrees. We would unload 1¼ pounds for each thousand pounds of gross weight for each degree, or (2 x 1¼ x 40)—100 pounds—the amount by which we should lighten the airplane in order to come reasonably close to maintaining the performance expected with standard air.

Loading Chart Easily Made

Obviously, a pilot crop dusting cannot stop to compute the load he can safely carry each time he fills his hopper. However, he can easily make a loading chart which will show how much load in pounds or gallons to place in the airplane for any given temperature and altitude. The time required to construct such a chart is little enough compared to the potentially disastrous result of being so heavily loaded that he gets off on ground effect and dribbles off the runway into the woods, or pulls up at the end of a spray run and mushes through trees or power lines.

Incidentally, supercharged engines will have an entirely different power curve, and the load bearing weight will not begin to drop off appreciably until the critical altitude of the supercharger is reached.

The turnabout procedure at the end of the swath run is a problem for some pilots because they are not familiar with the exact flying characteristics of their airplanes. The aerial applicator's turn is a 270 degree turn—first 45 degrees downwind, and then 225 degrees upwind to return to the new swath run. The turn is made at very low altitudes and (in the interest of saving time and fuel) with as short a radius as possible.

At the same time, the pilot must be on the alert for wires, poles, trees, tractors, or any other obstructions that may be found at the edge of the field. Since the altitude is usually less than 100 feet, the opportunity for recovery from a stall is brief, to say the least. Many pilots feel that safety lies in using full power during the turns, and turning fairly tightly. From the standpoint of safety and economy, a medium or 30 degree turn is much more desirable than either a shallow or a sharp turn, as can be observed from the chart below.

Angle of bank	0°	15°	30°	45°	60°
Ratio of lift*	1.0	1.04	1.15	1.41	2.0
Speed required*	60	61.7	64.5	71.3	85
Radius of turn*		955′	485′	340′	280′
Time to turn 270°*		50 sec.	24 sec.	15.4 sec.	10.6 sec.
Added time for banking and unbanking*		2 sec.	4 sec.	6.0 sec.	8.0 sec.
Total turn time*		52 sec.	28 sec.	21.4 sec.	18.6 sec.

* Data shown is representative only; exact figures would have to be calculated for each aircraft type.

In an airplane that can be safely flown at 60 mph, the safe speed required for a 30 degree turn is less than 5 mph faster than 60 mph. For a 45 degree turn, it is approximately 11 mph faster. For a 60 degree turn, it is 25 mph faster. The saving in time between the 45 degree and the 60 degree turn, only 2.8 seconds, is scarcely worth the additional hazard of turning so sharply at a low altitude.

Since the pull-up and turn at the end of a swath run is frequently made in the vicinity of wires or other obstacles, ag pilots must keep their eyes out of the cockpit as much as possible. This means developing the ability to gauge the angle of bank from the position of the wings, and the airspeed from the angle of attack.

No pilot, certainly, is qualified for safe aerial application until he is capable of stall recovery with a minimum of altitude loss. Only practice in the ag plane itself can establish the best technique of stall recovery. A really sharp pilot can recover without losing more than 25-50 feet of altitude—which is all the room to recover you may have under crop dusting conditions.

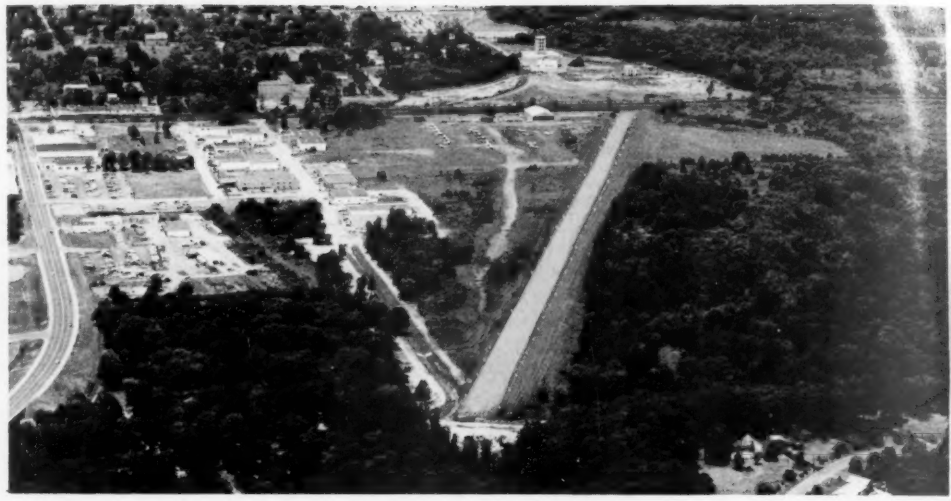
In the long run, aerial applicators come to realize the futility as well as the danger of pressuring the pilot to save operational time during a busy season by shaving split seconds from his turns. Employing top-notch ground men—reloaders and refuelers—will save more time and money day in and day out than making all turn-arounds 20-second turns, with the inevitable risk of a stall spin accident.

A. C. Reed
Supervising Inspector
General Aviation District Office
Albuquerque, N.M.

A third article in this series, discussing the toxicity of dusts and sprays, will follow.

Readers are advised that the technical reports on agricultural aircraft described in FAA AVIATION NEWS (June, 1968) are no longer available free from Aircraft Development Service. See PILOT BRIEFS on page 13 for current availability.

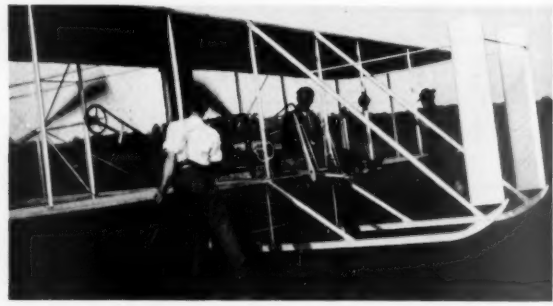
Artist's concept of a modernized airport/ museum, the "Williamsburg of Aviation", with paved airstrip and a memorial pavilion (not shown).



College Park Airport today, after nearly 60 years of continuous operation, is seeking a new lease on life. Earlier this year, its 2,500-foot runway was asphalt surfaced and illuminated. The lighting includes a rotating beacon and VAPI—visual approach path indicators. Below, right—Wright brothers trained Army pilots in the aircraft they built and sold. Left—In 1912 an Army officer successfully fired a Lewis machine gun from the air over College Park.

Historic College Park

Birthplace of U.S. Air Force struggles to survive as an active airport



A grassy triangle in the Maryland woods is struggling to stay alive as an active airport after nearly 60 years of continuous operation. The rollcall of famous airmen and aircraft whose wheels have touched down on its narrow 2,500 foot runway reads like an historic *Who's Who of American Aviation.*

The Wright brothers, who sold the U.S. Army its first airplane in 1909, trained the first Army pilots on a meadow in College Park, Md., a pleasantly relaxed farm community five miles northeast of Washington, D. C. The Wright's first flying school also became the nation's first military airfield and the world's oldest continually operated airport.

But today College Park Airport's identity is threatened by bustling urban activity on all sides. A private group, the National Aerospace Educational Memorial Center, Inc., has launched a vigorous campaign to preserve the airport and its heritage. Typical of their activity was a three-day airshow in August which featured, among other events, a re-enactment of the establishment of the Air Mail Service.

Despite the fact that it is now surrounded by residential or urban buildings, College Park Airport's 2,500-foot asphalt runway still accommodates a small fleet of general aviation planes. A fixed base operator operates a flying school on the field, and there is complete airframe and powerplant service available. About 30 light planes call it home base.

Even before the Wright brothers selected College Park as an aviation training site, pioneer flyers found the terrain and thermal conditions ideal for their experiments. Fred Fox, a glider pioneer, tinkered with his kites, and on many occasions managed to lift himself as high as 20 feet into the air, suspended from one of his contraptions.

Balloonists found the region hospitable, and Army balloonist Lieutenant Frank P. Lahm, recommended College Park as a military aviation site, after he had reconnoitered it from the air. Its mile-long and half-mile wide open space, bordered by windbreaking trees on both sides, and its proximity to Washington made it a natural choice.

Lahm, along with Lieutenants Frederick E. Humphreys and Benjamin D. Foulois, were the first military pilots to pass through the Wright's flying school. Foulois eventually became chief of the Army Air Corps, and Lahm became chief of training. Both played large-scale roles in organizing and leading the last big air battles of World War I.

The roster of aviation greats who first felt the rush of wind over wings at College Park Airport evokes nostalgic memories among airmen. To name only a few who won their wings at College Park: General H. H. "Hap" Arnold, Paul Garber, Rex Smith, William Whitney Christmas, Tony Jannus, Lincoln Beachy, Thomas Milling, Fred Orme, Paul Culver, and General James Doolittle.

Even the ladies got into the act—and into the air. Mrs. Ralph H. VanDeman tried her wings as a passenger on Oct. 27, 1909, flying with Wilbur Wright. The Army introduced the Navy to the air waves on Nov. 3, 1909, when Lieutenant Lahm, only a fledgling heavier-than-air pilot himself, took Navy Lt. George Sweet aloft.

It wasn't long before the Army lifted its ordnance into the blue. With Lt. T. Dewitt Milling at the controls, Capt. Charles DeF. Chandler riddled ground targets on June 7, 1912, firing a Lewis machine gun. It was only a short step to the next natural experiment—dropping crude bombs. Aerial photography followed swiftly after. Lieutenant Foulois sent the first series of radio mes-

Pre-WW I College Park Airport had half a dozen hangars. Curtiss (foreground) and Wright biplanes were in common use.

sages from an aircraft—messages which were heard up to 10 miles away—and "Hap" Arnold boosted his plane to a new altitude record of 6,450 feet in 1912.

Chevy Chase, Md., was "attacked" by an air "armada" of three Army planes, flying the world's first "mass" cross-country flight from College Park Airport. The Army was taking to its new weapon with energy and imagination.

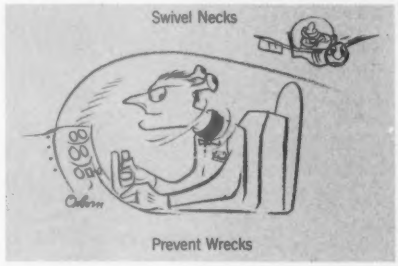
College Park ceased to be a military field in 1912, but by that time it was winging on its own. On Aug. 12, 1918, the airport became the Washington terminus of the world's first scheduled air mail service. An unusual piece of airmail was flown from College Park in 1919 when Douglas Fairbanks, Sr., was transported to Philadelphia to promote a Victory Liberty Loan Drive with an airmail stamp glued to his forehead.

Emile and Henry Berliner used the airport from 1920 to 1924 to flight test their early helicopter designs: the airport claims to be the site of the first controlled helicopter flight. From 1926 to 1933, the Bureau of Standards conducted experiments at College Park Airport with radio-guided blind landing systems. Pioneer flight instrument experiments were carried out here in 1931 by the Aeronautical Branch of the Department of Commerce.

While records were being made and broken in the skies above College Park Airport, the airfield continued to be a bustling center for "ordinary" flyers. College Park is still turning out pilots, and hopes to for many years to come.

Officials of the National Aerospace Educational Memorial Center, Inc. hope to turn the nation's oldest airport into a "Williamsburg of Aviation." Under their plan, College Park will continue to be an active airport, but it will also be a repository of aeronautical history, a center for education and scholarly research. ■

BRIEFS

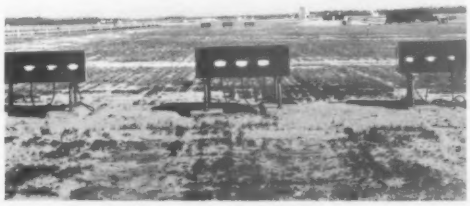


• FAR PART 91 HAS BEEN AMENDED to leave no doubt about a pilot's responsibility to maintain a vigilant watch for other air traffic. The new rule specifically states: "When weather conditions permit, regardless of whether an operation is conducted under IFR or VFR, vigilance shall be maintained by each person operating an aircraft so as to see and avoid other aircraft." The rule became effective immeditely upon its publication in the Federal Register, July 24, 1968.

• BIRD SCARING AND FROST DISSIPATION are no longer included in the list of activities lumped under the term "agricultural aircraft operation." FAA has redefined the term to permit certain types of agricultural flying, not involving dispensing pesticides or herbicides, to be performed without an agricultural aircraft operator's permit. Also exempted are "persons who drop live insects for pest control purposes." The change became effective August 1.

• DULLES AIRPORT IS NO LONGER DIA. The three-letter designator has been changed to "IAD" (International Airport Dulles) to eliminate confusion with the similar sound of DCA, air traffic shorthand for Washington National Airport. Corrections are being made in hundreds of aviation handbooks and manuals, weather sequence reports and charts, navaid maps and charts, air line timetables, baggage checks, Post Office Manuals, etc.

• A SIMPLIFED VASI has been approved by FAA for airports other than major hubs. A smaller, four-box VASI (visual approach slope indicator) has been developed to provide adequate daytime guidance at distances up to four nautical miles. A two-box system, approved for operations other than turbojet, is visible in daylight at three nautical miles. The VASI is a system of red and white lights at the approach end of a runway which help a pilot determine the correct approach attitude in VFR operations.



• FREE COPIES OF THE TECHNICAL REPORTS on ag aircraft described in the June, 1968 issue of FAA AVIATION NEWS are no longer free. They may be purchased at a cost of $3.00 each from the Clearinghouse for Federal Scientific and Technical Information, U.S. Department of Commerce, Springfield, Virginia 22151. Copies must be requested by title and order number: FAA-ADS-85, "Evaluation of the Piper PA-25B Agricultural Aircraft", Order No. AD 671 081.
FAA-ADS-86, "Evaluation of the Callair A-9 Agricultural Aircraft", Order No. AD 671 079.
FAA-ADS-87, "Evaluation of the Snow S-2C Agricultural Aircraft", Order No. AD 671 813.
FAA-ADS-88, "Evaluation of the Grumman AG-CAT Agricultural Aircraft", Order No. AD 671 082.
FAA DS-68-3, "Development of an Engine-Powered Liquid Dispersal System for Agricultural Aircraft", Order No. AD 671 891.

In simulated "crash" conditions during a test at the FAA's Aeronautical Center in Oklahoma City, Okla., passengers and crew were evacuated from discarded Lockheed SST hull mock-up in less than 1.5 minutes. The proper size and location of exit doors were also evaluated.

TESTS TO SPEED PASSENGER EMERGENCY EVACUATION

In a test program to shorten passenger evacuation time following emergency landings, FAA is seeking the best door sizes and locations by simulating emergencies in a mock-up SST hull.

The tests are being carried out at the agency's Aeronautical Center, Oklahoma City, Okla., under the direction of FAA's Civil Aeromedical Institute.

In the first test, 280 passengers and nine crew members were evacuated from a "crashed" SST in one minute and 27 seconds after the alarm bell was sounded. This bettered the target time by three seconds.

The "crew" consisted of three FAA instructor-pilots and six airline stewardesses.

The tests are being carried out under the most realistic conditions, beginning with the airplane's cabin, an SST mock-up built by Lockheed Aircraft Company. Lockheed donated the mock-up to FAA when Boeing was selected to build the SST.

Air Carrier Study Finds Operations Up, Accidents Down

There were fewer air carrier accidents in the U.S. in 1966, compared to 1965, despite a marked increase in flight hours and miles flown.

This is one of the comparisons emerging in the National Transportation Safety Board's *Annual Review of U.S. Air Carrier Accidents, 1966*. The report is a statistical comparison of air carrier accident data over a five-year period, from 1962 through 1966.

U.S. air carrier operations in 1966 recorded 75 flying accidents, eight of which were fatal and claimed the lives of 137 persons. In 1965, 226 died in nine fatal crashes out of 83 accidents.

In 1965, 35 crew members died in aircraft crashes, compared to 27 in 1966.

Air carriers flew 1.54 billion plane miles in 1965, compared to the 1.77 billion logged in 1966. Flight hours in this period rose from 4.69 to 5.11 billion.

The accident *rates* also were lower. The 1966 rate per million aircraft miles was 0.042 down from 0.054 in 1965.

Comparing certificated route carriers and supplemental carriers, the five-year analysis showed supplemental carriers had a higher percentage of fatal crashes among accidents in their domestic and international operations than did certificated airlines. Fatalities resulted in 18.6 per cent of supplemental carrier accidents, but in only 13.2 per cent of certificated carrier crashes.

The percentage of accidents in which the aircraft was destroyed was also higher among the supplementals—27.9 per cent—compared with 16.1 per cent for the certificated carriers.

International operations brought a higher percentage of accidents resulting in fatalities (16.3) than did domestic flights (12.7). The NTSB report shows that all-cargo flying had the highest percentage of accidents resulting in fatal injuries (42.1), and also the highest percentage of aircraft destroyed in accidents (47.4).

FAA Contract Seeks New Methods To Protect Airborne Recorders

Means of improving the survivability of airborne recording devices to withstand crash impact and fire will be investigated under a $37,975 matching fund from FAA.

Under the arrangement, FAA and the Sundstrand Corp., South El Monte, Calif., will each contribute half the cost.

Survivability might be improved by a different method of packaging the recording media, through insulating the recording tapes, development of fire resistant tapes, or in developing a new kind of recorder that could be used in present equipment.

Under FAA rules all U.S. scheduled and supplemental air carriers must be equipped with flight recorders and cockpit voice recorders to provide a continuous record of essential flight data, including crew conversations. Such data is vital in accident investigation and in accident prevention.

Under the contract, Sundstrand is required to report its findings and recommendations to FAA before June 30, 1969. Of major interest will be packaging and insulation. Methods recommended would have to meet the test of retaining recorded data in temperatures ranging from 2,000° F for a two-hour period, and at 500° F for a 16-hour period.

Lady Pilot is Airline Examiner

A lady aviator with more than 10,500 hours in her log book, over 7,500 of them as a flight instructor, has a new distinction.

Of the 23,000-plus active women pilots in the U.S., Miss Sylvia Roth, Vice-President of Miller Aviation, Inc., Cayce, S.C., is believed to be the only one ever designated by FAA as an airline transport pilot examiner.

In her career as a professional pilot for almost 20 years, Miss Roth has flown as a charter pilot and also as a corporate pilot.

Her ratings include: single-engine land, multi-engine land, and single-engine sea—all with commercial privileges; flight instructor (Gold Seal) airplanes and instrument; and ground instructor, advanced and instrument.

Despite logging an impressive aviation and business career, Miss Sylvia Roth still enjoys flying experimental aircraft.

FAA Aviation News welcomes comments from the aviation community. We will reserve this page for an exchange of views. No anonymous letters will be used, but names will be withheld on request.

• Cessna 170 Owners, Front and Center

I am forming an information center for all who are interested in the Cessna 170. Please write to me giving "N" number, year, total time, engine time, and any other information that would be helpful and interesting to other 170 owners. A postal card will do.

I am considering forming a club and, possibly, organizing a Cessna 170 fly-in.

John D. Benham
Route 4, Box 393
San Antonio, Texas 78228

• More on Mexico

A tip of the sombrero to Aviation News for "Flying Safely to Mexico" (May 1968). However, the list of publications on south-of-the-border flight overlooked one of the most useful guides available: "Baja by Air: A Cockpit Guide to Mexico's California" by Allen and Phyllis Ellis, Pan American Navigation Service, 12021 Ventura Blvd., N. Hollywood, Calif.

John Dohm
N. Hollywood, Calif.

• Torque and the P Factor

In the examination for a multi-engine rating, the question was asked: "In a two-engine aircraft with clockwise rotating engines, failure of which engine is considered more critical?"

I responded, saying that failure of the left engine was more critcial because of the torque and the pull of the right engine. This is correct—as far as it went—but when the examiner asked me to explain torque and the "P" factor I was lost.

I would like to know what effect torque and the "P" factor have on the flight of a multi-engine airplane with the left engine out.

Moorhead, Minn.

Torque is the tendency of an aircraft to turn in a direction opposite to that in which the propeller is turning. Since propellers in American aircraft turn clockwise, as seen from the cockpit, torque tends to turn the aircraft to the left. Obviously, the higher the power setting, the higher the torque.

The P factor refers to the fact that the thrust delivered by a propeller is the same at all points along the arc only when the propeller shaft is absolutely parallel to the direction of movement. Loss of an engine results in a nose-high attitude, which in turn produces an asymetrical thrust.

Under these conditions, the thrust of the propeller as it descends is much greater than when it ascends. This additional thrust on the right-hand side of the aircraft produces a strong tendency to turn left. With twin-engine aircraft, this tendency is more pronounced with the left engine out, since the heaviest thrust of the remaining engine will be far outboard to the right.

• No Simple Solution

Do you know if there is any research being done by anyone in relation to getting passengers out of uncontrollable aircraft?

Samuel Biana, Jr.
Piscataway, N. J.

Both civil and military aviation agencies have tried a number of different concepts to allow passengers and crew to safely escape from uncontrollable aircraft. These include parachutes for passengers, parachutes to lower disabled aircraft or portions of the aircraft, and ejectable seats.

While parachutes and ejectable seats have been used successfully by the military, so far no such means of escape have proven useful for untrained civilan passengers.

• Conspicuity

Under conditions of light haze, and sometimes even in clear CAVU weather, it is often amazingly difficult to pick out an airport from the air, even though one may be certain of its location.

I'd like to suggest that runway markings—centerline, numerals, etc.—be applied using reflective materials or paint. Perhaps these markings could be color-coded for various purposes.

L. A. Schulman
New York, N. Y.

FAA's Systems Research and Development Service is developing a new paint for marking pavements that will have good visibility, especially when wet. Also under study is the cost-benefit value of various reflectorized paints compared with non-reflectorized pavement markings.

• Non-voiced Omnis

Even though I use the enroute low altitude charts and include on my flight planning cards the *reporting* station to call for omnis without voice, I have called non-voice omnis. When I get no answer, my immediate inclination is to suspect radio transmission problems.

If we were permitted to call non-voice omnis with their identification and get response from the watch FSS for that station, three advantages would accrue: (1) it would reduce before-flight planning; (2) reduce radio chit-chat; (3) perhaps save cockpit confusion when a single pilot is aboard.

James I. Cornett
Colonel, USAF

Nothing precludes a pilot from initiating a call-up using the name of the VOR followed by "radio". In fact, FAA prefers this method of call-up as the flight service specialist can then answer on the omni frequency only, thus avoiding the use of the common en route frequencies which are usually congested.

But the pilot who calls the omni station having no voice communications must listen to an enroute frequency such as 122.1 or 122.6 MHz for a reply. In this case he may still use the name of the omni in his initial call, but he will receive a reply from the FSS on the enroute frequency. The answering station will use its own identification since it does not have voice communication capability on the omni frequency.

• Magnetic Mistake Makers

"How True is Your Omni" in the June *Aviation News* was very informative. I'd like to add a tip that might be helpful to all pilots.

On a trip with a student, we could never make the compass and omni indicator work out with any rational result. Checking the cabin, I found a flashlight with a heavy magnet on its side, used to secure it to metal surfaces, and the mystery was solved. I experimented, moving it to various positions in relation to the magnetic compass; the compass went wild, of course.

Is it possible for a magnet to have an effect on an omni receiver?

A. J. Martin
Jackson, Miss.

Yes, indeed. Magnets not designed into the cabin environment have no place in the vicinity of the instrument console since a number of instruments depend on their own, integral magnets to function. Among these are the omni receiver, cockpit radar display, cylinder head temperature, and tachometer.

• Seeks Surplus Military Aircraft

Where can I obtain information pertaining to the sale of surplus military aircraft? I understand this sale is being conducted by a Government agency on an Air Force base.

Hal J. Styles, Jr.
Studio City, Cal.

Complete information on the availability of surplus military aircraft can be obtained by writing to: Commander, Military Aircraft Storage and Disposition Center, Davis-Monthan AFB, Tucson, Ariz. 85708.

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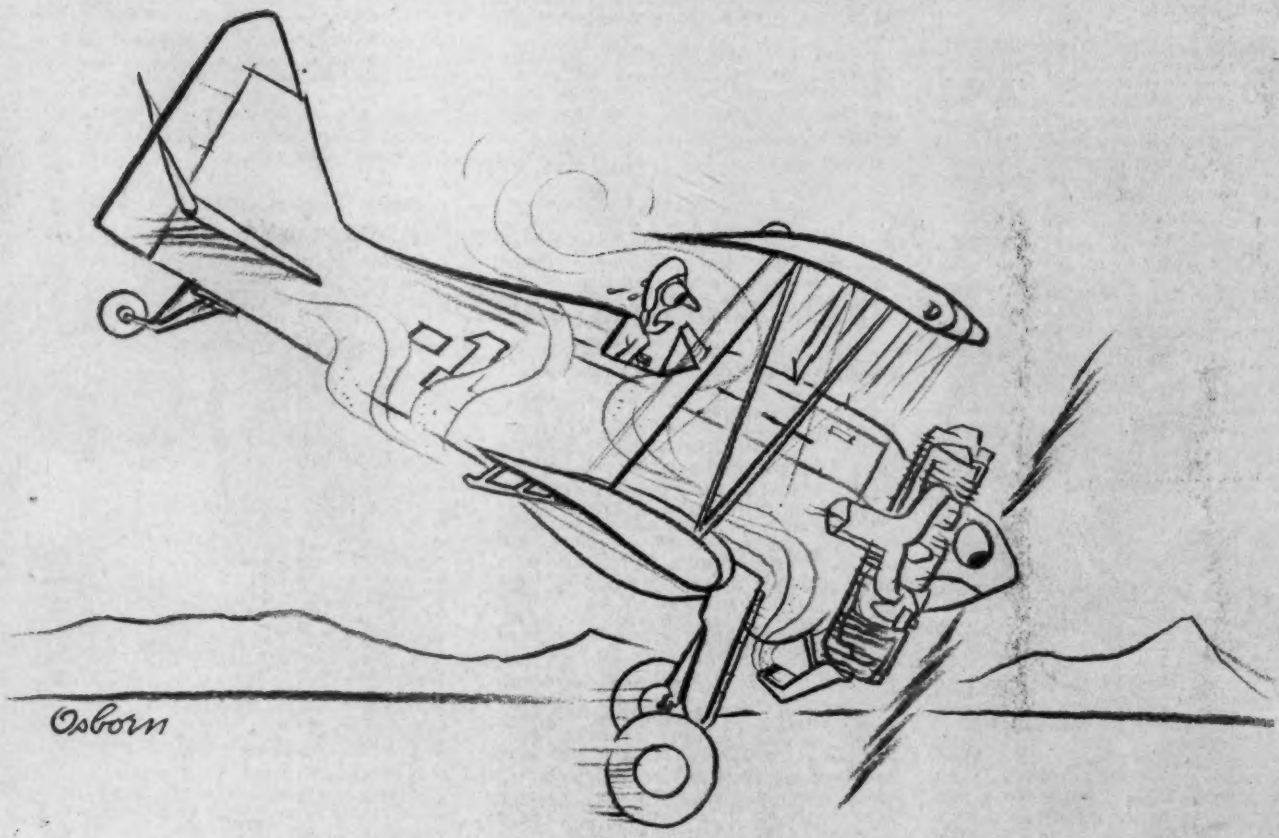
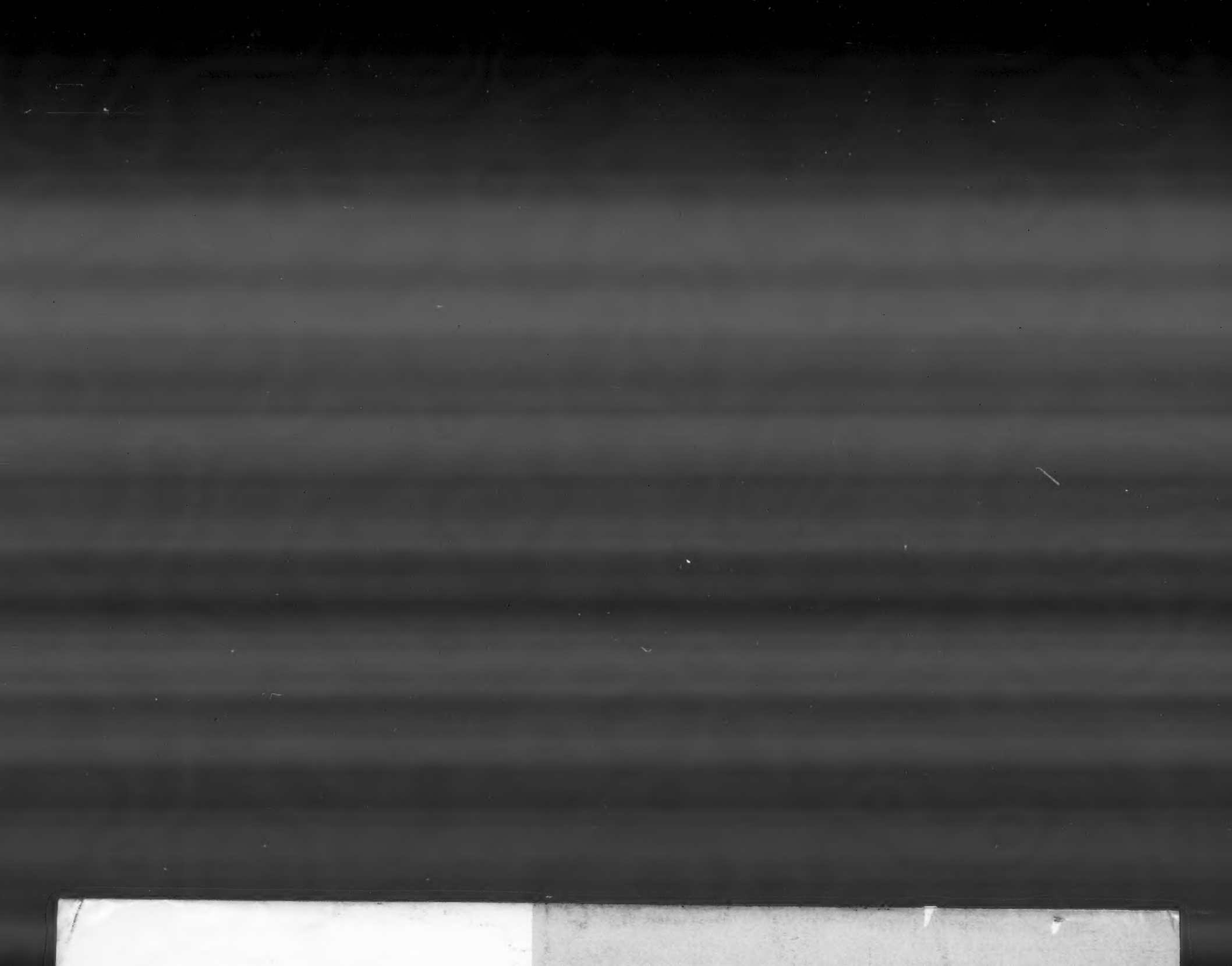
Can shorten a duster's working day.